

PUPARIA OF SALPINGOGASTER CONOPIDA AND *S. TEXANA*, WITH NOTES ON PREY (DIPTERA: SYRPHIDAE)¹

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The syrphid genus *Salpingogaster* Schiner consists of about 40 described species in Central and South America, with *S. nepenthe* (Hull) and *S. punctifrons* Curran known from Florida and *S. texana* Curran known from Texas. Immature stages of only *S. nigra* Schiner (Guppy, 1913), *S. dactylopiana* Blanchard (Blanchard, 1938) and a species probably correctly determined as *S. nigriventris* Bigot (Lahille, 1907) have been described. Data on the immature stages of "*S. nigriventris*" published by Sack (1920, 1921) and Bruch (1923) appear to be based on misidentified specimens. In the U. S. National Museum there are reared adults of *S. texana* and *S. conopida* (Philippi) pinned with puparia. I am describing the puparia and associated larval structures of these 2 species, and I am taking the opportunity to bring together the published and some new prey records.

TAXONOMY

Salpingogaster belongs to the tribe Bacchini and appears to be most closely related to *Baccha* Fabricius. A deeply looped third vein of the wing of *Salpingogaster* has been the classical character used to distinguish this genus from *Baccha*. However, this character does not hold for the subgenus *Eosalpingogaster* Hull. The presence of heavy ventral spines on the apical part of the hind femur in *Salpingogaster*,

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as opposed to bristly hairs in this location in *Baccha*, is a more reliable distinguishing feature. *Salpingogaster* was classified into 2 subgenera by Hull (1949), who proposed *Eosalpingogaster* for *S. conopida*, *S. nepenthe*, and *S. dactylopiana*, and stated that these species have the "Corners of first abdominal segment with a sharp hook. Third vein with only a very low curve". The corners of the first abdominal segment range from sharply hooked to evenly rounded in specimens of *Eosalpingogaster* that I have seen. The third vein of *Eosalpingogaster* is very unlike the deeply kinked third vein of *Salpingogaster s. str.*, and is depressed into the first posterior cell to about the same extent as in most species of *Baccha*.

Eosalpingogaster includes *S. macula* Schiner, *S. nigriventris*, and *S. texana* in addition to the 3 species mentioned by Hull (1949). *Salpingogaster macula* and *S. nigriventris* were placed as synonyms of *S. conopida* by Shannon and Aubertin (1933), who had seen the co-types of *S. nigriventris*, and by Fluke (1956). This synonymy should be re-examined as study of the *Eosalpingogaster* specimens in the U. S. N. M. collection indicates that there is considerable variation in color patterns and that there are useful specific characters in the male genitalia.

Published Information on the Immature Stages of *Salpingogaster*.

Guppy (1913) presented very superficial descriptions and figures of the eggs, larvae, and pupae of a species that subsequently was determined as *S. nigra* by Pickles (1932). Blanchard (1938) included a good lateral view of the puparium of *S. dactylopiana* with his original description of the species.

Considerable confusion surrounds the papers by Lahille (1907), Sack (1920, 1921), and Bruch (1923) on "*S. nigriventris*". Lahille (1907) presented a rather superficial drawing, in color, of the dorsum of a puparium of "*S. nigriventris*". He included a dorsal view of the adult in color, and a figure of the wing. In his revision of *Salpingogaster*, Sack (1920) included a drawing of the puparium of "*S. nigri-ventris*" without comment, and republished the same figure with a brief description in 1921. Sack's figures and descriptions (1920, 1921) of the adult and puparium show that his species is quite different from Lahille's. Sack's statement (1921) that, ". . . die geschwungene dritte Längsader, die die erste Hinterrandzelle fussförmig erscheinen lässt

...”, may indicate that his “*S. nigriventris*” is a species of *Salpingogaster s. str.*, but the characters of the puparium indicate that it is a species of *Baccha*. Bruch (1923) figured the larva, puparium, and adult of “*S. nigriventris*” and stated that he owed his determination to Sack, but it is not clear that Sack had actually seen his specimens. Bruch’s (1923) photograph of the dorsum of the adult compares well with Sack’s (1920, 1921) figures of the thorax and descriptions. Bruch’s and Sack’s figures and descriptions show that the larvae and pupae of their “*S. nigriventris*” do not have the large tubercles that are characteristic of *S. dactylopiana* as figured by Blanchard (1938), of “*S. nigriventris*” as figured by Lahille (1907), and of *S. texana* and *S. conopida* as described herein. The shape of the puparium of “*S. nigriventris*” as shown in Bruch’s (1923) photograph is similar to *S. dactylopiana*, *S. texana*, and *S. conopida*, but in Sack’s (1920, 1921) figure the dorsum is more sharply downward sloping posteriorly and the posterior end of the puparium is more attenuate. Both Sack and Bruch mention 4 brown spots on the mid-dorsal line of the puparium of “*S. nigriventris*”, whereas in *S. texana* and *S. conopida* (and possibly in *S. dactylopiana*) the mid-dorsal line is unmarked but there are dark markings in front of the paired dorsal tubercles on segments 7 and 8. The figures of the cephalopharyngeal skeleton and posterior spiracles of “*S. nigriventris*” presented by Bruch are not precise enough for comparisons with my specimens of *S. texana* and *S. conopida*. Bruch’s statement (1923) that the species treated by Lahille (1907) is a different species of the genus *Baccha* and that a tuberculate puparium is characteristic of *Baccha*, seems to be only partly correct. Lahille’s species is different from Bruch’s, but it is probably Bruch’s species that belongs to *Baccha*.

DESCRIPTIONS OF PUPARIA

The puparia of *Eosalpingogaster* are more similar to those of *Baccha* than to any other known Syrphinae. There are published figures and descriptions of the puparia of *Baccha clavata* (Fabricius) (Heiss, 1938), *B. elongata* (Fabricius) (Scott, 1939), *B. fascipennis* Wiedemann (Harris and Hamrum, 1968), *B. fuscipennis* Say (Heiss, 1938), and *B. pulchrifrons* Austen (Bhatia and Shaffi, 1933). In the U.S.N.M. there are puparia pinned with adults of 9 additional species (*B. capitata* Loew, *B. costata* Say, *B. dimidiata* (Fabricius), *B. dolosa* Williston, *B. gastrostacta* (Wiedemann), *B. lemur* Osten Sacken, *B.*

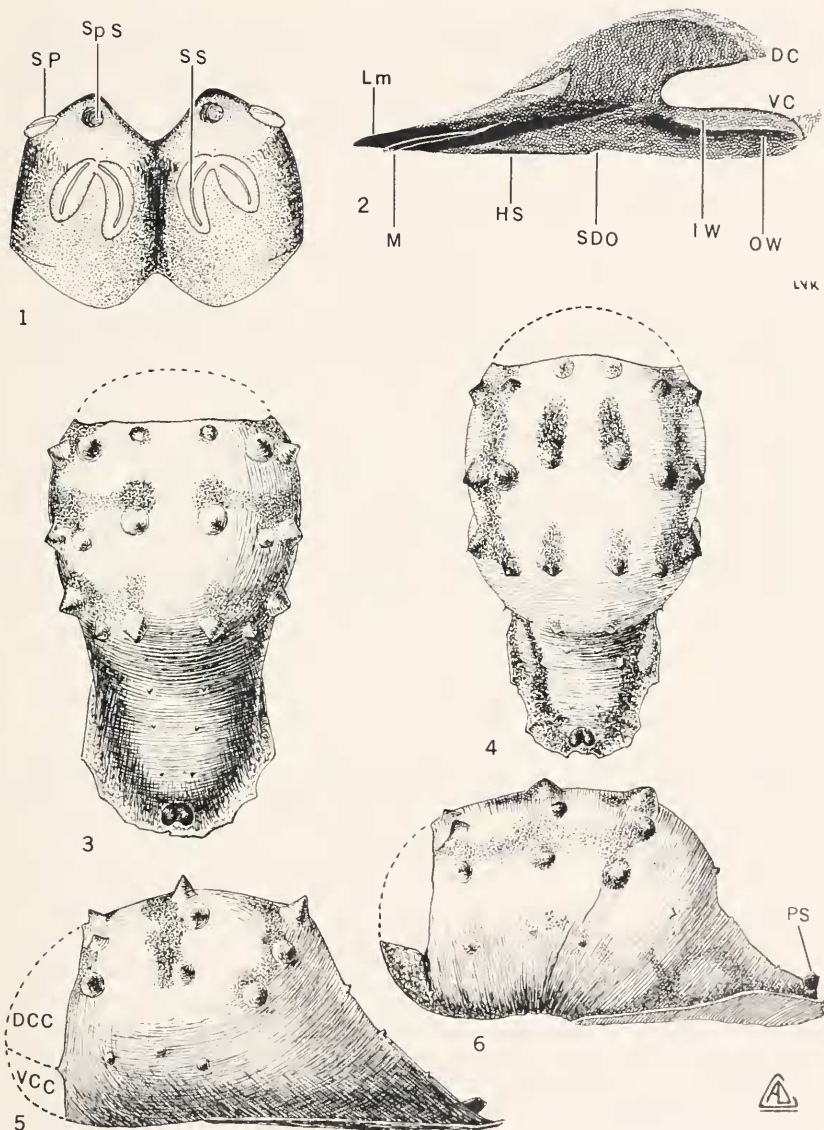
loewi Sedman, *B. stenogaster* Williston, and *B. zeteki* Curran). None of the puparia of these 14 species or that of "*S. nigri-ventris*" as described by Sack (1920, 1921) and Bruch (1923) has wart-like body tubercles. However, puparia of *Salpingogaster conopida*, *S. dactylopiana*, *S. texana*, and "*S. nigri-ventris*" as described by Lahille (1907) have 3 transverse rows of wart-like tubercles dorsally, dorso-laterally, and laterally on the anterior, robust portion of the body (segments 6, 7, and 8), and a series of smaller tubercles on the posterior segments. Puparia of some species of *Baccha* differ in shape from those of *Salpingogaster* in being very elongate (e. g., *B. elongata*) or evenly tapered posteriorly (e. g., *B. clavata*), whereas other species (e. g., *B. fascipennis*) are similar in general outline to *Salpingogaster*. None of these 3 species of *Eosalpingogaster* has the small, lappet-like tubercle vestiges that are typical of *B. clavata*.

Salpingogaster (Eosalpingogaster) texana Curran

PUPARIUM

(FIGURES 1, 2, 4, 6)

Length (entire), 6.0 mm; greatest width, 3.0 mm; greatest height, 3.2 mm; width of conjoined posterior spiracular tubes, 0.53 mm; length of posterior spiracular tube, 0.25 mm. White with brownish spots on most tubercles; a short, indistinct brownish patch dorsolaterally and a smaller, darker patch ventrolaterally on segments 6, 7, and 8; margin of sole (attachment of ventral surface to substrate) infuscated, especially posteriorly. Segmentation indistinct, integument minutely and evenly shagreened. Clavate, rounded anteriorly, entire ventral surface flat, strongly sloping posteriorly from segment 8 to apex. Segments 1-5 forming cephalic caps, dorsal cap missing. Major, robust portion of body composed of segments 6, 7, and 8, this portion not as evenly rounded as in *S. conopida*. Transverse row of paired tubercles on segments 6, 7, and 8: segment 6 with 1 pair of small dorsal tubercles and 2 pairs of larger dorsolateral tubercles; segment 7 with 1 pair of large dorsal tubercles and 2 pairs of smaller dorsolateral tubercles; segment 8 with 1 pair of very large dorsal tubercles and 2 pairs of smaller dorsolateral tubercles; segments 6, 7, and 8 each with 1 pair of minute lateral tubercles, much smaller than lateral tubercles of *S. conopida*. Segments 9, 10, and 11 each with 1 pair of minute, approximate, dorsal tubercles and segment 9 with a small upper dorsolateral tubercle. Sole extending from segment 8 to apex. Posterior spiracular tubes (Fig. 1) faintly rugose, subshiny, black, broadly contiguous, together a little more than twice as broad as long, anterior basal margin evenly arcuate, posterior basal margin deeply incised. Each spiracular plate with a black spiracular scar (SpS) in upper, inner corner; a spiracular slit (SS) in upper, outer corner; and a pair of basally converging slits on lower margin. All slits narrow, slightly curved, yellow and surrounded by shiny spiracular prominence; slits extending over edge of plate and half way down side of spiracular tube. Cephalo-



FIGURES 1-6. Fig. 1. *Salpingogaster texana* Curran. Posterior spiracles of pupa, posterior view. Fig. 2. *S. texana*. Cephalopharyngeal skeleton, from puparium, lateral view. Fig. 3. *Salpingogaster conopida* (Philippi). Puparium, dorsal view. Fig. 4. *S. texana*. Puparium, dorsal view. Fig. 5. *S. conopida*.

pharyngeal skeleton (Fig. 2) length 0.825 mm, brownish; labrum (Lm), anterior portion of pharyngeal sclerite, and outer wing (OW) of ventral cornu (VC) black. Only the paired mandibles (M) form a discrete sclerite. Remaining sclerites fused and margins indefinite, some anterior sclerites not visible in this specimen. Based on 1 specimen: U. S. A., Texas, Mission; in USNM.

Salpingogaster (Eosalpingogaster) conopida (Philippi)

PUPARIUM

(FIGURES 3, 5)

Length (entire), 6.7 mm; (without cephalic caps), 5.5 mm; greatest width, 3.3 mm; greatest height, 3.0 mm; width of conjoined posterior spiracular tubes, 0.44-0.50 mm; length of posterior spiracular tube, 0.19 mm. Uniformly straw-yellow to light brown or slightly darker dorsally in front of tubercle bases and posteriorly along sides of sole. Segmentation indistinct, integument minutely and evenly shagreened, without remnants of spinules. Clavate, rounded anteriorly, entire ventral surface flat, strongly sloping posteriorly from segment 8 to apex. Segments 1-5 forming cephalic caps, dorsal cap missing in both specimens. Major, robust portion of body composed of segments 6, 7, and 8. Transverse row of paired tubercles on segments 6, 7, and 8: 1 pair of large dorsal tubercles, 2 pairs of large dorsolateral tubercles, and 1 pair of much smaller lateral tubercles. Segments 9, 10, and 11 each with 1 pair of minute, approximate, dorsal tubercles. Sole extending from segment 9 to apex, integument very thin except around margins. Posterior spiracular tubes smooth, shiny, black, broadly contiguous, together about twice as broad as long, anterior margin evenly arcuate, posterior margin deeply incised. Each spiracular plate with a spiracular slit in upper, outer corner and a pair of basally converging slits on lower margin, spiracular scar not evident. All slits narrow, straight, only slightly lighter than surrounding raised, shiny, spiracular prominence; slits extending over edge of plate and half-way down side of spiracular tube. Cephalopharyngeal skeleton as described for *S. texana*, length, 0.825 mm. Based on 2 specimens: Peru, Rio Charape, 29.8, C. H. T. Townsend, and Brazil, São Paulo, 7.21.1919, H. F. G. Sauer; both specimens in USNMNH.

PREY RECORDS

The 9 reared species of *Salpingogaster* have been reported, or are recorded below, as predators of froghoppers (*Aeneolamia* Fennah, *Cephisus* Stal, *Mahanarva* Distant, *Sphenorhina* Amyot and Serville, and *Zulia* Fennah), aphids, (*Aphis* L. and *Toxoptera* Koch), and

Puparium, lateral view. Fig. 6. *S. texana*. Puparium, lateral view. DC, dorsal cornu; DCC, dorsal cephalic cap; HS, hypopharyngeal sclerite; IW, inner wing; Lm, labrum; M, mandible; OW, outer wing; PS, posterior spiracle; SDO, salivary duct opening; SP, spiracular prominence; SpS, spiracular scar; SS, spiracular slit; VC, ventral cornu; VCC, ventral cephalic cap.

scale insects (*Coccus* L., *Dactylopius* Costa, *Diaspis* Costa, and *Pseudaulacaspis* Macgillivray).

Subgenus *Eosalpingogaster*
Salpingogaster conopida (Philippi)

This species has been recorded as a predator of *Cephisus sicciifolius* Walker (Aphrophoridae) on *Acacia* sp., *Cassia* sp., and *Eucalyptus* sp. in Brazil and Argentina. It in turn is parasitized by *Ethelurgus rufipes* (Brèthes) (Ichneumonidae), *Prosaspicera cerasina* (Brèthes) (Figitidae), and *Trichomalus poltiventris* Brèthes and *Pachyneuron syrphiphagum* Brèthes (Pteromalidae) (d'Araújo e Silva, et al., 1968).

Biological data associated with specimens in the USNM are as follows: S A Par Labo Montevideo, No. 145.32, iss X.15, H. L. Parker, Est de São Paulo Braz, predator of *Coccus viridis* [(Green) Coccidae] 1 ♂; same data except, X.16.40, No. 145.33, 1 ♂. S A Par Labo Montevideo, No. 451-51, iss V.20, H. L. Parker, Predactor Cotton Scale, Chaco Arg., 1 ♀. Montevideo, So. Amer. Paras Lab. Date X.26.41, Host, scale, Parker, Maldonado, Urug, 2 ♂.

Salpingogaster dactylopiana Blanchard

This species was described from specimens reared from *Dactylopius indicus* Green (Dactylopiidae) in Argentina (Blanchard, 1938).

Salpingogaster nepenthe (Hull)

Hull (1943) described this species from Bonita, Florida, and stated, "Ex *Dactylopius tomentosus*." The holotype and 2 paratypes in the USNM collection are labeled, "Ex *Dactyl. tomentosus*".

Salpingogaster nigriventris Bigot.

Lahille (1907) stated that *S. nigriventris* was found feeding on *Pseudaulacaspis pentagona* Fargioni-Fozzetti (Diaspididae) in Argentina. Sack (1921) stated that, "Dr. Zürcher fand die Puppe am 8.VIII.1913 in der Nähe von St. Trinidad. Wahrscheinlich nähren sich die Larven von kleinen Zikaden." Bruch (1923) reported this species preying on *Lecanium perinflatum* Cockerell (Coccidae) on

"*Cestrum parqui*, black peach" and "otras solanaceas". Sack's and Bruch's determinations seem to be incorrect, and their material may belong to the genus *Baccha*, or to *Salpingogaster s. str.*

Salpingogaster texana Curran

The holotype, which is in the American Museum of Natural History, is labeled, "*Salpingogaster texana* type ♀, on *Dactylopius californicus*, [SIC] Brownsville, Texas, Feb. 11, 1915, Timberlake Coll." The puparium is mounted beneath the fly, and both of the cephalic caps are missing. Curran (1932) corrected the name of the prey in his descriptions and stated, "TYPE . . . larva feeding on *Dactylopius confusus* [Cockerell (Dactylopiidae)]. The single female in the USNM, whose puparium is described above, is labeled, "(Mission, Tex., III.17.27) (pupated III.26.27, Emg. IV.7.27) (F. F. Bibby Collector) (see pupa) (Host *Dactylopius tomentosus* Lam[arck]) (*Baccha conopida* Phil. det. C. T. Greene)". The puparium is attached to a piece of cactus, pinned separately, and is labeled, in the same hand, "*Baccha conopida* Philippi, see adult, Mission Tex., IV.7.27".

Salpingogaster sp.

An unidentified, possibly undescribed, male in the U. S. N. M. collection is labeled, "Argentina, Tucuman, Feb. 1932, bred from larvae preying on cochineal, 1 ♂ No. 548.31." The male genitalia are specifically distinct from those of *S. conopida*.

Subgenus *Salpingogaster s. str.*

Salpingogaster nigra Schiner.

A short outline of the life cycle of an unidentified syrphid, the larvae of which prey on *Aeneolamia varia saccharina* (Distant) and *Zulia pubescens* (Fabricius) (Ceropidae) on sugar cane in Trinidad was published by Guppy (1913). Pickles (1932) referred to the species treated in Guppy's paper as *S. nigra*, presented additional biological data, and considered *S. nigra* as the, ". . . chief predaceous enemy of *Tomaspis saccharina* [= *A. varia saccharina*] . . ." in Trinidad.

Biological data associated with specimens in the USNM are

as follows: Campeche, Mex., IX.58, J. Ledere, 59-11947, *Aenolamia* sp. [Cercopidae] on sugar cane, 1 ♂, 1 ♀.

Salpingogaster pygophora Schiner.

According to d'Araújo e Silva, *et al.* (1968), this species preys on immature *Mahanarva rubicunda indentata* Walker (Cercopidae) on sugar cane, elephant grass, and imperial grass in Brazil.

"*S. ? pygophora*" was cited as a predator of *Sphenorhina rubra* (L.) in Trinidad by Pickles (1932).

Salpingogaster spp.

"*Salpingogaster* sp." was recorded as preying on adult and immature *Sphenorhina liturata ruforivulata* (Stal) (Cercopidae) on sugar cane and various grasses in Brazil by d'Araújo e Silva, *et al.* (1968). These authors also cited a "*Salpingogaster* sp." preying on *Aphis gossypii* Glover and *Toxoptera citricidus* Kirkaldy (Aphididae) in Brazil.

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2.0087. Puparia of *Salpingogaster conopida* and *S. texana* with notes on prey (Diptera: Syrphidae).

ABSTRACT.—The puparia of *Salpingogaster conopida* (Philippi), *S. texana* Curran, *S. dactylopiana* Blanchard, and *S. nigriventris* Bigot (Diptera: Syrphidae) are clavate and similar in shape to those of the 14 reared species of the related genus *Baccha* Fabricius, but they are distinguished from the latter especially by transverse rows of dorsal, dorsolateral, and lateral wart-like tubercles on segments 6, 7, and 8. The publications on the immature stages of *S. nigriventris* by Sack (1920, 1921) and Bruch (1923) probably are based on misidentifications. Larvae of several species of *Salpingogaster* in Florida, Texas, and Central and South America are predators of froghoppers (Aphrophoridae and Cercopidae), scale insects (Coccidae, Dactylopiidae, and Diaspididae), and aphids (Aphididae) on sugar cane and various other plants.—L. V. KNUTSON, *Systematic Entomology Laboratory, USDA, c/o U.S. National Museum, Washington, D.C. 20560.*

DESCRIPTORS: Diptera, Syrphidae; *Salpingogaster*; puparia; prey; Neotropical.